Government Perspectives on the Future of Advanced Networking Technologies

Combined briefings presented at:

GLOBALCOMM Government Summit
June 5, 2006

and

GLOBALCOMM Innovations Summit
June 7, 2006

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Overview of the NITRD Program

- **Networking and Information Technology Research and Development (NITRD) Program**
  - Statutory basis for the NITRD Program
    - High-Performance Computing Act of 1991
    - Next Generation Internet Research Act of 1998
  - NITRD Subcommittee, National Science and Technology Council
    - Representatives from 13 program agencies + OMB + OSTP + NCO/NITRD
    - Has two Interagency Working Groups (IWGs) and five Coordinating Groups (CGs)
  - Budget of $3.1 billion proposed for FY 2007

NITRD National Coordination Office (NCO)

- Serves as the Federal focal point for interagency technical planning, budget planning, and coordination for the Federal networking and IT R&D portfolio
- Supports NITRD-related policy making in the White House Office of Science and Technology Policy (OSTP)
- Serves as a source of timely, high-quality, technically accurate, in-depth information on accomplishments, new directions, and critical challenges for the NITRD Program

NITRD Program Coordination Groups

White House
Executive Office of the President

Office of Science and Technology Policy

President's Council of Advisors on Science and Technology (PCAST) serving as the **President's Information Technology Advisory Committee (PITAC)**

National Science and Technology Council

Committee on Technology

Committee on Homeland and National Security

National Coordination Office (NCO) for Networking and Information Technology Research and Development

Subcommittee on Networking and Information Technology Research and Development (NITRD)

Subcommittee on Infrastructure

High End Computing (HEC) Interagency Working Group (HEC I&A and HEC R&D)

Cyber Security and Information Assurance (CSIA) Interagency Working Group

Human Computer Interaction and Information Management (HCI&IM) Coordinating Group

Large Scale Networking (LSN) Coordinating Group

High Confidence Software and Systems (HCSS) Coordinating Group

Social, Economic, and Workforce Implications of IT and IT Workforce Development (SEW) Coordinating Group

Software Design and Productivity (SDP) Coordinating Group

American Competitiveness Initiative (ACI)

- **Calls for a doubling over 10 years of the investment in three Federal agencies — NSF, DOE/SC, and NIST — that support basic research programs in the physical sciences and engineering**
- **All three agencies are NITRD Program members**
- **2007 budget increases exceed the % increase in the overall proposed NITRD Program budget**
  - NSF: ⇧12%
  - DOE/SC: ⇧35%
  - NIST: ⇧10%
  - Collective increase for ACI agencies is $186 million (17% above 2006 estimates)
  - ACI agency budgets accounts for over 85% of the overall NITRD Program budget increase for 2007

Administration R&D Priorities

- **Excerpt from July 8, 2005 memo on 2007 Administration R&D Priorities (issued jointly by the White House Office of Management and Budget and the Office of Science and Technology Policy):**

  Advanced networking research (including test-beds) on hardware and software for secure, reliable, distributed computing environments and tools that provide the communication, analysis and sharing of very large amounts of information will accelerate discovery and enable new technological advances.

Definition of the LSN PCA

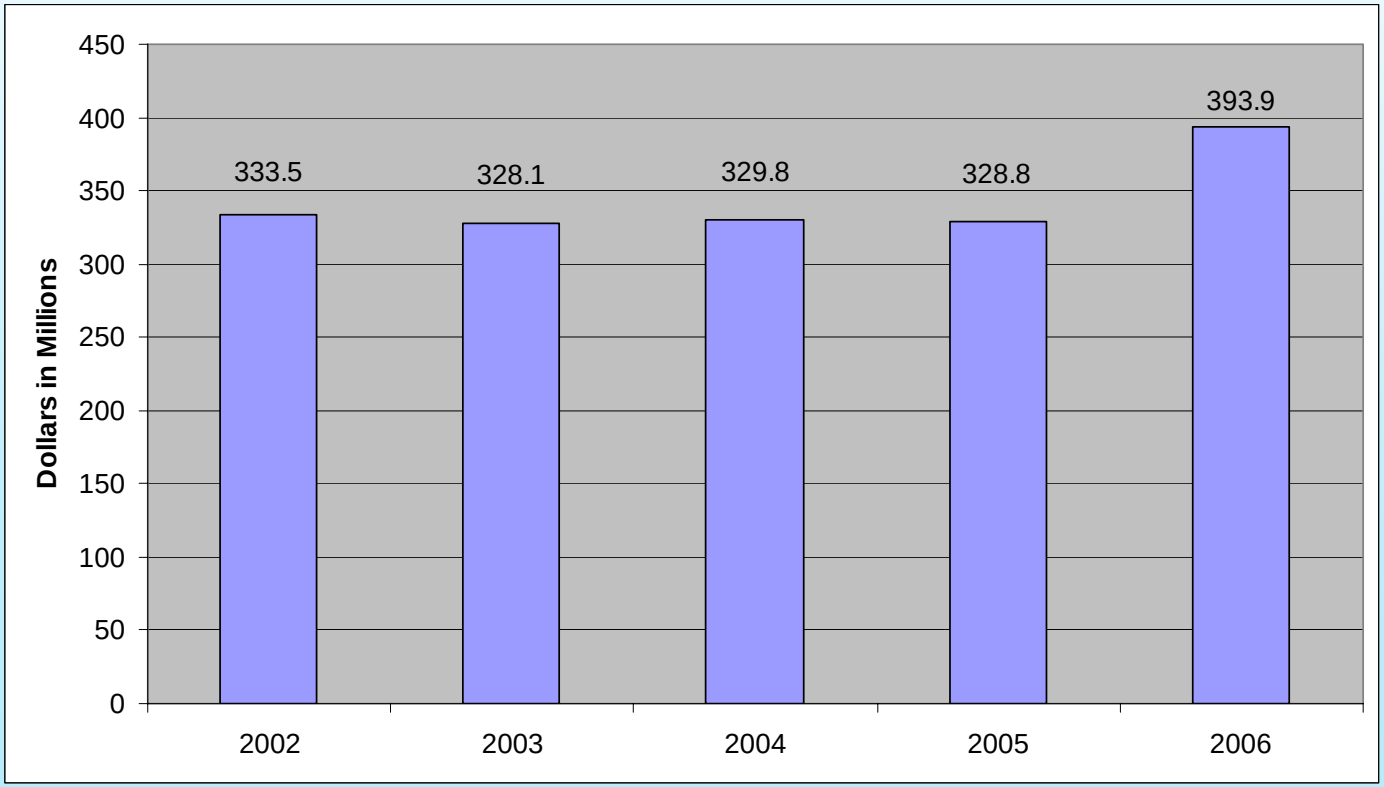
- **R&D in leading-edge networking technologies, services, and enhanced performance, including:**
  - New architectures, optical network testbeds, network security, infrastructure, middleware, end-to-end performance measurement, and advanced network components
  - Grid and collaboration networking tools and services
  - Engineering, management, and use of large-scale networks for scientific and applications R&D

LSN Agencies

- **NITRD agencies**
  - Agency for Healthcare Research and Quality (AHRQ)
  - Defense Advanced Research Projects Agency (DARPA)
  - Department of Energy/National Nuclear Security Administration (DOE/NNSA)
  - Department of Energy/Office of Science (DOE/SC)
  - National Aeronautics and Space Administration (NASA)
  - National Institute of Standards and Technology (NIST)
  - National Institutes of Health (NIH)
  - National Oceanic and Atmospheric Administration (NOAA)
  - National Science Foundation (NSF)
  - National Security Agency (NSA)
  - Office of the Secretary of Defense (OSD) and Department of Defense Service research organizations
- **Other participating agency**
  - United States Geological Survey (USGS)

Large Scale Networking Budget Profile

- FY 2007 LSN Budget Request: $404.5 Million
- Four funders account for over 90% of the LSN investment:
  - DOD (41%), NSF (21%), NIH (18%), DOE Office of Science (11%)



LSN Accomplishments

- Implementation of 9000 Byte MTU for research networking to improve performance
- Continuous upgrades to bandwidths of Federal research networks
- Held Optical Networking Testbeds Workshop 2, August 2005
- LSN and LSN Team representation expanded to include DoD
- Established Research and Education Network Operations Group (RENOG) for international cooperation on trouble shooting

LSN Planning and Coordination

- **Upcoming meetings:**
  - LSN Workshop on Future Internet and Experimentation Facility Design (July 2006)
  - Optical Networking Testbed Workshop 3 in coordination with the Global Lambda Integrated Facility (GLIF) and the international community (September 2006)
  - Discussions ongoing with TIA on subject of holding a government/ industry/academia workshop on networking R&D needs
- **Testbed coordination:**
  - Monthly optical control plane cooperation meetings
  - Close cooperation among testbeds: DRAGON, CHEETAH, HOPI, UltraScience Net, NLR, OmniNet, StarLight

LSN Interagency Priorities for FY 2006-7

- **End-to-end performance measurement**
  - Goal: Develop metrics to support fault isolation and correction, attacks on resources, and management of network resources
  - Action: Develop plan to integrate programs across agencies.
- **Multidomain issues, e.g., control plane, QoS, cross-domain services**
  - Goal: Provide common services for signaling and management across domains
  - Action: Monthly telecons among optical network testbed developers
- **New architectures for global Internet infrastructure**
  - Goal: Develop a new Internet architecture and associated large-scale testbed for innovative research on secure, robust, and manageable communication services
  - Action: Hold a workshop to define needs and plans for future shared deployed Internet architecture

LSN Technical Highlights for FY 2007

- Optical networking testbed coordination
- Sensor networking
- Wireless, ad-hoc, secure networking, mobility
- Coordinate IPv6 deployment in Federal research networks in conformance with OMB guidelines
- Software development, maintenance, and support
- Cyber trust and federation of trust across domains
- International cooperation, e.g., optical networking testbeds, federated security regimes, connectivity

Looking Forward

- **My personal views…**
  - Where will money be spent?
    - Infrastructure
  - The next big things – nearer term:
    - Next-generation converged networks
    - Rewrite of the Telecommunications Act
  - The next big thing – longer term:
    - Next generation Internet architecture(s)
  - Key issues:
    - Interoperability
    - Quality of service and performance measurement
    - Security, authentication and identity
    - Migration from existing infrastructure to future infrastructure
    - Economics and business cases

Looking Forward

- **Key technologies:**
  - All optical networking and switching
  - Dynamic end-to-end optical circuits
  - Virtual control planes
  - Federated identity management
  - Cyber Security
- **R&D advances needed in diverse areas including:**
  - Optical computing, ultra-high-speed networking, signaling, network management and control, protocols,

    … and the development of new services

    … and deployment of new infrastructure

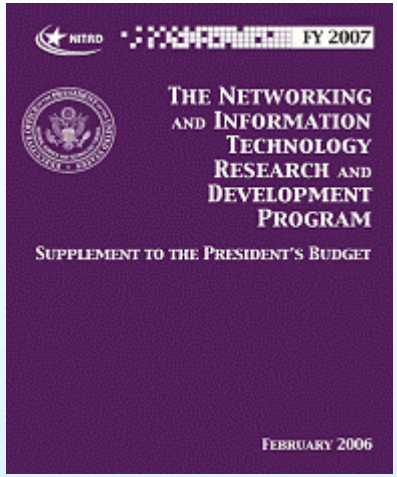
    … to enable new applications.

Looking Forward

- **Near-term priorities for Federal LSN agency programs and coordination:**
  - **Optical networking testbeds to address multi-domain issues (e.g., dynamic networking, control plane issues, QoS)**
  - **New architectures for global Internet infrastructure**
  - **End-to-end performance measurement (coordination between LSN Coordinating Group, Federal research networks, Internet2, etc.)**

Comments or Questions?

- More detailed information is available in
  The FY 2007 Supplement to the President's Budget for the NITRD Program



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